Preparation of biomaterials composite with mechanically coated particles

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Abstract: New preparation routes have been investigated for enhancing mechanical properties of a biomaterial composite consisting of with high-density polyethylene (HDPE) reinforced with hydroxyapatite (HA). HA was used as fine particles to coat each coarse particle of HDPE with an elliptieal-rotor-type mixer and with a high-speed rotational impact blending machine. The effect of particle size of HDPE and mixing conditions were studied on mechanical properties of the composite material, such as rotor speed, total treatment time, number of preparation steps and total volume fraction of HA. In comparison, it was found that the embedment besides uniform coating and dispersion of HA fine particles onto the surface of HDPE core particle was easily achieved by rotational impact blending, due to high impact energy. This yielded relatively high properties. However, multi-coating steps or layers were required due to a high percentage of powder loss during operation. In contrast, uniform and tight coating of core particles was performed without particle loss by elliptical-rotor-type mixing. Nevertheless, due to a slight embedment of fine particles by gentle shear and compressive stress, HA could not disperse uniformly due to aggregates generated by the molten HDPE of core particles escaped through the thick and loose coating layer during material formation. This resulted in a weak bonding among coated particles to yield lower mechanical properties.

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